

Accelerator Systems Division Highlights for the Week Ending April 6, 2001

ASD/LBNL: Front End Systems

A setup with positive, 0.36-mm, offset against the LEBT axis was tried out for the first time with ion source #1 but resulted in larger emittance and slightly higher residual beam steering at the LEBT exit than found with 0.76-mm negative source offset. Zero source offset resulted in negligible residual steering, but still somewhat larger emittance than the best values measured earlier. One last setup will be tried out before determining on the condition to be actually used for the planned RFQ Module #1 beam experiments.

Commissioning of the LEBT chopper system with beam has started.

With source #2, an attempt to achieve rapid cesiation at full power and nominal duty factor resulted in failure of the steel/quartz antenna and coating of the interior source surfaces, which inhibited H- generation. We have now asked the SNS ion-source group to pursue the option of having a copper antenna coated with a more uniform and durable insulating layer than the "art-grade" porcelain used up to now. After performing a thorough service, various ignition scenarios involving dual-frequency operation and filament assistance were studied on source #2. So far, the dual-frequency mode alone gives the best results, and 13.56-MHz RF power of only 20 W c.w is sufficient to obtain the fastest pulse rise times.

RFQ Module #2 has undergone the final copper-to-copper braze; the Module #3 vane-subassemblies are being ground to final dimensions, and the Module #4 vane-subassemblies are ready for finish machining, waiting for fixtures that are currently being used with #3 vanes.

The RFQ 402.5-MHz klystron system has been reassembled after repair of the power supply, and after initial difficulties caused by miscommunication the system has reached 1 MW pulse power output into a water load at about 3% duty factor. This power level was confirmed both by directional couplers and calorimetry and is fully adequate for commissioning of the entire RFQ.

A discussion on the Low-Level RF systems for the MEBT rebunchers was held on 3/23 with ORNL staff attending, examining LBNL-internal fabrication issues.

Four FES staff members attended (parts of) the 75% Conventional Facilities design review in San Francisco.

An Earned-Value audit of the Front-End Systems was held by W. Foyt on 3/ 27-28.

A final design review of the MEBT support stand and rafts was held on 3/30.

A Director's Review of the Front-End Systems was held on 4/3.

ASD/LANL: Warm Linac

The Litton 2.5-MW R&D klystron was severely damaged during conditioning at the factory last week. When the klystron was disassembled, they found a large water-to-vacuum leak at the start of the collector cone. (WBS 1.1.2.7)

The bids for the DTL PMQ-type drift-tube fabrication were received this week. We are performing the technical evaluation and plan to have the contract in place by the end of April. (WBS 1.4.2)

We distributed the SNS Drift-Tube-Linac Water-Cooling and Resonance-Control-System Final Design Report (SNS-104020500-DE0001-R00) for the final design review, scheduled for April 11. See http://sns.atdiv.lanl.gov/pdf/des/DTL_Water_FDR_report_4-5-01.pdf. WBS (1.4.2.5)

We received the prototype EMQ for the CCL this week. The magnet-mapping stand is being assembled in preparation for testing the prototype EMQ over the next three weeks. (WBS 1.4.4)

Orders were placed for fabrication of the ground plane and circuit board machining for the first two production chopper structures. (WBS 1.4.5.1)

Orders were placed for fabrication of the first three DTL BPMs and for the layout of the digital front end (DFE) circuit board. (WBS 1.4.5.2)

We made preliminary estimates of the required response time for the beam loss monitor (BLM) and machine protection system (MPS) to prevent damage to copper RF structures. The estimates show that significant damage can occur for full-current beam loss below 100 MeV unless the MPS can respond in less than about 10 microseconds. (WNS 1.4.5.3)

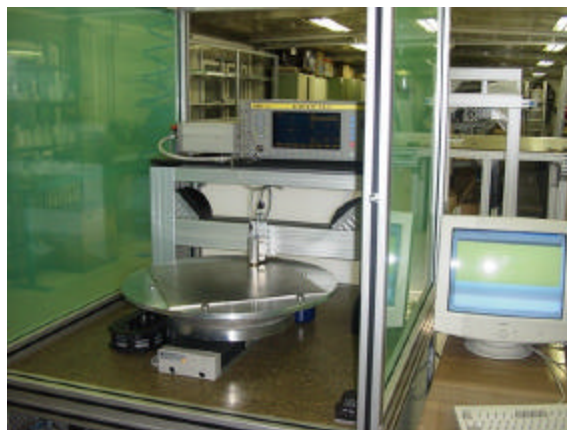
We made simulations for performing delta-t phase scan measurements on DTL tank 6 and concluded that using the absorber-collector method is probably better. The combination of short physical length and small longitudinal phase advance would require BPM phase resolution of better than ± 5 ps. (WBS 1.4.5.3)

The 1.6-m-long warm-section assembly drawing released last week raised concerns about cost and complexity of this region. We are examining alignment and assembly requirements with JLAB to determine if a simplification is possible. (WBS 1.4.9)

ASD/JLAB Cold Linac

Fabrication on the Warm Compressors, Cold Compressors, and 4.5K Coldbox continues.

The Eddy Current Scanner System was inspected at manufacturer (photos attached)





High beta cavity #5 has been BCP'd and is in the vertical dewar for testing.

The medium beta HOM couplers are being manufactured.

Preparations continue for the high power Fundamental Power Coupler test at LANL. The first pair has been moved to the 20 kW RF system for check out. They should be shipped to LANL on 13-Apr.

The two-cavity MB configuration system test was completed, which completed the MB HOM modes study. Welding the single cell MB Nb cavity and the remaining cavity ends continues.

Activities continue for the three high beta HOM modes considered dangerous for power generation if not sufficiently damped. The two 5th harmonic modes have been found. In contrast to the situation in the MB cavities, the final mode being looked for does not propagate into the beam tube.

The EP parts RFP was released; specification for the EP cabinet has been started.

The Space Frame and the Magnetic Shield contracts were awarded. The Vacuum Tank bids are being evaluated. Reactor grade Nb bids are due back by 23-Apr. Cavity ends bids are due back by 30-Apr. The Cavities prebid meeting will be held 18-Apr; bids are due 16-May.

The installation cost PCR for the 1MW RF system has been prepared (LI 00-068).

The LANL 1MW RF system plan for JLab testing needs to be approved (LANL LI 01-035). In the fall of 1999 as part of the MOU discussion, it was agreed that SNS would provide a skidded RF system for the JLab testing of CM's and power couplers. It is needed in the second Q FY02 to test the Prototype CM at full power. If the PCR is approved now, the best LANL can do is deliver a system after we start full 1 CM per month production. (Depending on interpretation, this is also a several month slip in the Milestones #1b-3 and 2-30.) The ASAC last year raised this as one of the highest priorities. This system is a key element not only for conditioning and acceptance testing but also is the key to raising the High Beta Gradient from 27.5 to 35.0 MV/m. The immediate approval of this PCR is required to get LANL started working on this. The transmitter can be here in Jan 02; the Modulator can be here 10 months after notice to proceed (Feb 02 if LANL started now). This would have the system installed and checked out when the Klystron arrived.

The CHL BOD has slipped 8 months; it is now after the last of the refrigeration equipment has been delivered. The installation, commissioning, and burn in schedule has been compressed by 4 months to recover half of this slip, but the sub-system acceptance test deadlines and most of the warranties will have expired. The A&E is developing the RFE dates and is expected to get them to us within the next two weeks.

ASD/BNL: Ring and Beamlines

A major effort was spent on addressing our PCR backlog. These activities included:

- Addition of chromaticity sextupoles
- Relocation of extraction PFNs
- Beam height adjustments using the extraction septum
- Low field corrector power supplies
- 21/26 cm split quad power supplies
- RTBT mineral insulated correctors (rad. hard)
- Lattice revision (rev. "D")
- Still in the works are "give backs" for the 27CDM30 and the 12Q40 procurements (after contract award).

The cost and schedule proposal presented by Danfysik for the 12Q40 / Corrector magnet assembly is being reviewed. We expect to award this contract to Danfysik when they return from Easter holiday.

The close out report from the CF, Title II, 75% review has been received and is being reviewed by BNL staff.

The Parameter List, rev. #5 has been received from D. Olsen. BNL staff is reviewing the subject entries.

The Ring Lattice drawing, rev. "D" per PCR RI 01 022, is complete and being circulated for signature approvals.

Tom Shea is visiting BNL this week to review Diagnostics issues with P. Cameron and his staff. Areas of particular interest are related to Technical Handoff, ICDs, Timing, and LANL/BNL integrated work scope and efforts.

ICD for Vacuum and Controls is complete and on the web.

Allied Engineering is scheduled to start cutting chips on the first production ring arc dipole magnet core this week.

First half-cell support has been fabricated and undergoing final machining and inspections. See photo, below.



Controls:

The controls lab at 701 Scarboro is being expanded to accommodate increased personnel, activity and equipment. A new technician, Brian Moss, has been hired and began working on this project this week. Controls lab space has been cleaned out (partitions removed) and agreement within the Controls group for the equipment layout in the room has been reached. Instrument racks, tables, storage shelves, tools, and instrument components have been moved into the lab.

Plans for installing a door in the wall between the lab and room 317A have been finalized with the 701 Scarboro Rd. building owner. This door is the proposed standard entrance door for the tunnel access stations and will be tested to demonstrate its effectiveness as such. The building owner will purchase and install the door.

The driver for the Event timing master is being written at BNL, and will be completed shortly.

Printed circuit board design is complete for the MPS chassis and related status display board. This was done in house due to excessive estimates from outside contractors. The design will be sent to a PCB manufacturing house when a suitable company is located, sometime next week.

Use of the SNS standard MVME2100 PPC processor has been demonstrated for VXI. This will allow the standard processor to be used for all crate-based IOCs - in particular for the LLRF systems.

The EPICS Gateway was successfully tested at LBNL, with live front-end test stand data displayed at ORNL.

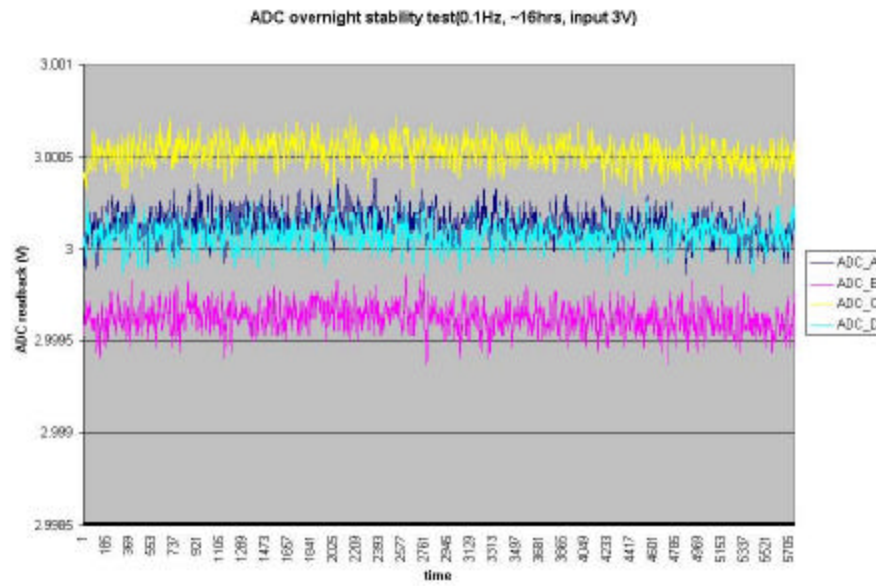
The Graphics editor GDCT is now available in dynamic and static form for all SNS platforms (Solaris, Linux).

All Group-3 and Flex-IO interface hardware that will allow completion of the front-end control system has been delivered to LBNL

Design of a system to protect the proton beam window and the target shroud from overheating caused by inadequate cooling supplied by the target utilities is under design. A special hard-wired system, independent of the Machine Protection and Personnel Safety systems is proposed. This trip function requires a highly reliable system because damage to the proton beam window or target shroud will have a significant economic impact on the facility. Part of our evaluation is to determine the economic impact and the reliability of the trip systems.

The first order of PLC parts for the PPS development lab has been received. Also received is the computer that will be used for PLC programming and networking.

The prototype driver for the BNL power supply controller is approximately 50% complete. Stability tests on the standard power supply interface are continuing at BNL. Some results are shown below.



This is a plot of the ADC stability. It measures a fixed voltage over 16 hours, and shows almost no variation over time. During the test the temperature variation was 5 to 10 degrees.

ASD/ORNL: Integration

Accelerator Physics

John Galambos visited BNL to discuss SNS linac space charge issues with Ingo Hofmann, who is on an extended stay there. Initial simulations for SNS cases were begun.

Eugene Tanke wrote a note on dark current in the warm linac, consequent x-ray emission, and shielding strategies.

Sang-Ho Kim and Mark Delaneau calculated the transverse kick due to the fundamental power couplers in the SRF linac as a function of entrance phase and beta.

Energy spectrum data for the DTL and CCL were calculated by Dong-o Jeon for the determination of the degradation energy.

Andre Shishlo visited Oak Ridge and successfully installed and demonstrated the UAL Code on the AP Group Linux computer cluster.

Operations

Installation and RATS Building

We're in the process of extending the city water piping to feed the DI water system that will be installed in the next couple weeks. The concrete pad for the cooling tower and DI system skid will be formed and poured by early next week.

The layout of the RATS building is now final (see attached layout). The survey people have snapped lines on the floor defining each area. Plans are coming in from the different groups for the installation of utilities to their areas. We now have the ability to bring in craft support thru the AECM for these installations and currently have an Electrician wiring equipment for the cryo transfer line group.

There has been some confusion over our ability to receive at RATS. We have the ability to receive equipment and components at RATS, this system will be electronic soon but in the interim Don Smith will notify the appropriate party when their equipment is received.

Based on information gathered at the cable tray workshop held last week in Los Alamos, the Estimate is nearly complete for the ASD tray installation in the FELK. The conduit and cable-pulling estimate for the FELK will follow.

A workshop is being held today to estimate the labor to install the components in the HEBT tunnel.

Magnet Measurement Group

In Los Alamos, efforts are underway to measure the CCL Quad prototype. We are buying a coil from Aster, which will be used to measure HEBT 12Q45's. We are designing a coil system to map HEBT dipoles. JG is busy with software applications and data analysis Robert McBrien went to Labview training this week.

Ion Source Group

An analysis of potential materials for improved antenna coatings was completed with input from the ORNL Metals and Ceramics Division and from several other experts. To improve the antenna lifetime, the desired coating material should have a minimal emission yield of secondary electrons, a high thermal conductivity and a high melting point, a low vapor pressure and a low sputter yield at elevated temperatures, and a finite resistivity. In addition one has to be able to deposit the coating in a thin, but uniform and homogeneous layer with minimum porosity, forming a smooth surface, which is stable under reducing conditions. Three oxides, Cr₂O₃, TiO₂, and Y₂O₃, out of 60 different materials considered, give the best match of the desired properties. Our initial efforts will focus on Cr₂O₃, the best all around candidate, because it has been widely used in a number of related applications.

RF Group

Test cart with two fundamental power couplers has been baked out successfully at the JLAB. Waveguide doorknob transitions have been attached to the couplers. Low power RF measurement showed reasonable RF matching: return losses at the two-waveguide ports were -23dB and -21dB.

Met with convention facilities to discuss power conditioning and harmonic filtering.

Working on reformatting installation labor estimates for RF systems. FDR for HVCM tentatively scheduled for May 24, 2001.

Cryo Transfer Line Group

The indoor pipe storage racks are assembled and we are moving pipes from the ORNL bulk stores area to the storage rack.

The pipe wash station tank is installed and operational.

The DI water system used for the final rinse of the pipes is installed and operational.

The high-pressure washer portion of the pipe cleaning station is being fitted with the final piping configuration.

The piping crew has started the installation of the H₂O water feed portion of the magnet DI system.

The CAM system used in the assembly of the cryo transfer lines is in place and operation. No CAM software exists yet.

The Transfer line assembly tables are in place and being modified to accept the current transfer line design.

The cryo vacuum people are processing the vacuum pumps we acquired from salvage.

The pipe mandrel drawings for the super insulation winding table are in the machine shop for fabrication.

Fabio Casagrande has joined the group as a cryogenic engineer.

A meeting was held with three possible vendors that we will use to extract the purifier from the Y-12 area. Several high cost items were identified in the scope of work and we are presently removing these issues from the requirements. We will ask for a best and final quote next week.

We have started interviewing for the cryomodule support staff that will be send to "J" lab for the cryomodule assembly.

Mechanical Group

To provide updated requirements and design guidance to CF, the following ASD transmittals were issued this week

- a. RF Facility Requirements (Transmittal #67)
- b. FELK and Ring 75 % Design Review Items (Transmittal #72)
- c. HEBT Service Building Requirements (Transmittal #74)
- d. Ring Service Building Requirements (Transmittal #75)

Transmittal #72 indicates ASD acceptance of nearly 40 changes agreed to at the 75 % design review in SF. Most of these changes will result in cost savings to the project.

The LANL-SNS hand-off planning effort for warm linac mechanical systems (DTL and CCL) is continuing. The original spreadsheet developed by LANL, which specifies resources, activity schedules, and lead, mentor, consulting plans, has been iterated by ASD and returned to LANL. This will be discussed at LANL next week.

Power Supply Group

A job offer was made for an associate engineering position to a candidate and was accepted. The new employee will start 6/4/01.

Procurement of the instrumentation necessary to perform incoming testing of power supplies continues. This week members of the group met with manufacturers of automated test equipment software and hardware.

The PCR for stripper the stripper foils development and testing program has been approved. A meeting was held with the ORNL and the U of Tenn. Members of the research team (Drs. Shaw and Feigerle) to discuss initial schedules and scope of work.

Members of the group provided input for the continuing optimization of Conventional facilities design.

Survey and Alignment Group

A good deal of the S & A efforts for the last two weeks have been in the preparation of a statement of work required for the installation of the site survey monuments. Our goal is to have a functioning exterior global survey network in place by a 15 June 01 completion date. Although we are well aware, that as a result of on-going construction, all necessary monuments cannot be installed at this time. However, a significant number can which will provide a good starting point. The statement of work is now in the hands of the appropriate Conventional Facilities people who are working on implementing the SOW.

The layout of each group's individual area in the RATS Building was completed. Additionally, a number of smaller layout tasks have also been accomplished.

Continued work on a .dwg read/write program for extracting and writing coordinate data directly into AutoCAD.

Continued ongoing coordinate lattice development and the interfacing of that lattice with presently approved drawings.

Diagnostics Group

BPM: Raw materials for striplines and outer shells of the BNL PUEs were received. Two pre-production 21cm HEBT PUEs are being assembled in preparation for brazing. Machining of outer shells and striplines of two pre-production 12cm HEBT PUEs is in progress. Drawings of 30 cm Ring and 36 cm RTBT PUEs were submitted to shops for estimate. Given the small incremental cost, the decision was made to add PUEs to all HEBT 12cm quads. Inquiries about trim coils for HEBT and RTBT quads revealed that they are already a part of the package for all except 12 cm quads, permitting beam-based alignment in HEBT and RTBT. The possibility of adding trim windings to the 12cm quad package is under investigation. John Power produced a draft ICD documenting the controls interface for the BPM/phase system.

IPM: A preliminary design for the IPM magnet has been prepared. Because this magnet is a picture frame design, this will necessitate a different transducer head from that in RHIC. The electron detector has been bench tested with a new gain and brought to 911B for more tests. Modifications to the wire scanner cross were completed to permit installation of an electron detector in RHIC.

BLM: Continued to investigate improvements to the design of the BLM internal circuitry. A preliminary system brochure was released.

BCM: Schematics of the AFE prototype have been completed and sent to layout. Tom Shea met with BNL staff to discuss BCM schedule, interface to PCI, timing, and calibration.

Linac D-plate: The Beryllium discussion continued

Tune: Continued investigation of possibility of detailed probing of tune space with high frequency resonant pickup and high frequency kicker combination.

Carbon Wire Scanner: Additional engineering manpower was added to the wire scanner effort. Linear actuator received from Huntington.

Laser Wire Scanner: MEBT laser platform profile is being modified to remove a small interference. Laser and optics radiation hardness is under investigation.

Global: Tom, Dave, and Saeed met with FNAL staff to discuss the following: experience with PC based instruments, the FNAL diagnostics network protocol (still in design), the new general purpose ADC module, possible use of the SNS timing industry pack, and CDF's use of Smartsockets message oriented middleware server. Dave Purcell ordered the nanoengine processor card. This is the module used in the LBL emittance electronics. It will be set up at ORNL to perform integration testing. Tom Shea met with BNL staff to plan handoff strategy. He heard many good suggestions that will be presented by Marty at next week's handoff meeting. Racks for the linac diagnostics may not be in the budget. We are investigating. We plan to hold diagnostics meeting in Chicago near the time of PAC. Tom attended a few minutes of the controls phone conference and requested an event link master for LBL by mid May.

